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COMMUTERS -- STAY HOME!

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COMMUTERS -- STAY HOME!

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Abstract

Commuting imposes serious cost, time, and social burdens on individuals and society. It should not be considered primarily as a transportation problem but as a part of a complex economic and behavioral system in which the functions and structure of the work location and the commuter's residence are of greater import. A potential alternative to routine commuting is the concept of "remote work," by which a worker conducts office-type activities in his house or apartment or through a neighborhood work and telecommunications center, yet travels to his employer's office at appropriate times for orientation and motivation. With substantial transportation and office rent savings and enhanced economic utilization of residential space, this new approach may be cost effective in reducing intracity as well as suburban commuting. Technologically feasible, the partial substitution of telecommunications for commuting requires behavioral changes that would be hastened by requiring "door to door" pay by employers as a management incentive to revise job patterns and develop innovative office output procedures. It also would encourage the socially desirable merging of office structures and residences, perhaps reversing urban decay through self-interest and a smoother transition to a possible future pattern of closer-in, "walk to work," hiring implied by present energy crises and administrative decisions on local minority employment. A development program to demonstrate the effectiveness of remote work, evaluate its impact on economic and social patterns, and promote phased implementation is proposed.

Introduction

Secretary of Housing and Urban Development George Romney once made the humanitarian suggestion that we offer a "tithe of time" -- 10 per cent of the nominal 40-hour week -- in well-conceived volunteer efforts to help solve urban problems.⁽¹⁾ This seems unlikely of realization unless a substantial amount of disposable time were added to what we now have. Most of us do not work just an 8-hour day, but must put in 10, 11, or more hours, door to door, because of the relentless demands of commuting. If we could reduce travel to work substantially, we would gain not just 10 per cent, but 20 to 30 per cent or more in potentially productive hours. It is startling to realize that in commuting just one hour each way we expend in unproductive activity the equivalent of well over one 8-hour day every week. During a full career of 40 years or so, we discard 10 years of equivalent working time. Curiously, while society is gravely concerned with depletion of natural resources, there is little awareness of this major

waste of human potential.

Concern over the physical and environmental aspects of commuting has grown dramatically over the past decade, and today there is widespread recognition of the congestion caused by rush-hour highway traffic, the effect of thoroughways on urban life, deterioration of mass transit, pollution by noise and exhaust fumes, and the high cost of transportation systems. In fact, commuting is fast approaching (and for some has exceeded) a threshold of intolerability. To note only one apposite and vivid presentation, *Newsweek* early this year featured an article that it appropriately titled "The Agony of the Commuter".⁽²⁾ Most solutions conceived today turn sensibly -- in the present context of unthinking acceptance of commuting as an unalterable condition of economic life -- on construction and rehabilitation of mass transit systems, or even to starting all over with "new towns." Few have asked the question, "Why commute at all?", and even fewer have given this question any systematic consideration.

An in-depth analysis would require that we take a systems approach to the economic and social network in which commuting is embedded. Commuting, after all, is only a means (today almost the exclusive means) by which the expertise of a given individual is brought to bear on the production of the world's goods and amenities by physically transferring him from his home to his place of work. Analysis of the commuting problem must include a consideration of the functions of the place of work (a desk in an office building is most typical today) and also of the home in which the employee is refurbished and stored until again being required at his distant work station.

When we thus extend our thinking about commuting beyond the transportation network to the office that the commuter enters, we are struck with the extraordinary effort that today's economy expends in getting us together to do our jobs. We build enormous buildings at high cost (the World Trade Center will cost \$650 million to house 50,000 workers, for example), and these buildings for the most part stand empty 128 of the 168 hours in the week, 76 per cent of the time. So many office buildings are going up in New York City (25 per cent of all such construction in the country)⁽³⁾ that serious concern has been expressed over the disappearance of life from large areas of the city after the five o'clock exodus. To move millions of commuters to these empty shells and silent streets, we are building multi-billion dollar mass transit systems -- the new Second Avenue subway in New York City, the Bay Area Rapid Transit (BART), and the Washington,

D. C., METRO. Great capital and labor costs are imposed by the "peaking" of passenger loads during the rush hours, with manpower and vehicles kept idle during off-peak hours. Of course, others than commuters will use these systems, but the needs of shoppers, medical patients, vacationers, and school children could be met for many generations by less costly arrangements. The large capital costs alone, per employee and per commuter, of office structures and commuting suggest strongly that a search for practical alternative ways of accomplishing the same ends, taking account of both economic and human factors, would be highly justified from a cost benefit point of view.

The Unused Home

At the other end of the commuting trail, we find a house or apartment that, like the office, is surprisingly underutilized, partly as a result of today's trend to smaller families, with the children soon into their school years, and an increasing percentage of working wives, currently estimated at 40 per cent. At the same time, an increasing percentage of homes are equipped for full-time living, and for that matter, working. Office facilities such as the telephone and environmental amenities such as air conditioning are becoming universally duplicated in homes. Floor space equivalent to that occupied by the worker at the office also is available. (The existence of urban housing that does not conform to these conditions may be in part a result of the present commuting system; this is discussed later).

Residences constitute a large part of our national wealth (over 25 per cent), and are valued in the aggregate at some 800 billion dollars. About \$33 billion is spent annually on housing and apartment buildings, curiously just about the amount spent on nonresidential construction.⁽⁴⁾ Yet, except for a few artists and professional people, no one in urban areas works at home.

Are there alternatives to the home-office-commuting system that might tap the vast unused capital represented by the space, communication facilities, and presence of workers in individual places of residence?

Such considerations lead directly to the key question: "Is commuting an economic necessity?". This is not stated too precisely. We could give up all commuting to go back to subsistence farming on an acre of land, never traveling farther than the nearest village, dying at age 30, and until then using the barest minimum of mechanically produced goods. So the question might be expressed: "Is continuation of the present pattern of working and living, in which massive commuting is an indispensable element, an imperative if we are to maintain a high standard of living, and for which we shall be forced, by economic necessity, to pay in lost time, tension, unlivable cities, and unhealthful environment?". If so, and we have not merely become habituated to only one of many equally effective (or superior) work patterns, there is nothing that can be done except to watch and participate while displacement of urban life by buildings continues, more massive commuting systems are built, and commuters make longer and longer trips to ever more distant suburbs.

Most of us, certainly municipal administrators, if faced unequivocally with such a future, would be shocked into searching for new approaches. For those who have been, there has been a common, early perception that a technology already exists that, subject to deeper analysis, should provide a feasible alternative. The concept -- and we must not jump to conclusions as to how it would be applied in practice -- is that of substituting telecommunications for commuting. The National Academy of Engineering, which has studied ways in which telecommunications may be used to alter metropolitan functioning and to shape metropolitan form, states: "The concept of a direct substitution of telecommunications for transportation is as old as telecommunications itself".⁽⁵⁾

The concept has received some academic attention and has been commented on offhandedly by various commentators and writers; but only a few significant evaluations have been published, and these have not presented quantitative projections nor in-depth analyses. It is time that the potential contributions of telecommunications to revised and enhanced living and working patterns be brought into full public awareness, and that the concept receive the attention of scientists, engineers, management, administrators, urban planners, and all others concerned with the city and with society.

As science writer Arthur C. Clarke says, "Don't commute, communicate".⁽⁶⁾

When we examine the substitution in more depth, we find that there is much, much more to the idea than merely reducing the time we spend traveling to the office. It has the most profound social and cultural implications for urban living -- and not necessarily negative implications. The negative attitude that telecommunications will mean the end of the city by dispersing its inhabitants all over suburbia and exurbia is well shown in an advertisement by an electronics firm that asks, "Is New York really necessary?".⁽⁷⁾ Clarke also states a belief that telecommunications will mean the "death of cities". As we shall see, perhaps just the opposite will be demonstrated, with the city being enhanced for desirable living.

A Nation of Message Handlers

Speculation on substituting telecommunications for commuting bases its feasibility claims on the large percentage of work that is done in offices, rather than factories. Today, four out of five new jobs in the city are in white collar work, and industry continues to drift away. White collar work consists in handling messages, either vocal or written. When we hold face-to-face conferences, read incoming letters and answer them, refer to files -- either by going to a file cabinet or by calling up a computer record for display on the screen of a cathode ray tube -- we are processing messages. The final output is a message to someone else and it must go through some communication process or media. Office workers do not work at machines -- unless the machines are typewriters, duplicators, computers, or microfilm cameras and readers, all of which are simply extensions of human message handling activities.

Because we are nodes in a message-processing network, we can, hypothetically, be located anywhere that can be connected to the network. The present close proximity to others in the same office could -- to the extent that the proximity is not essential in a behavioral sense to accomplishing the office goals -- be expanded to remote locations connected by electronics, by rapid delivery of written communications, or by travel to the office when needed but at less structured hours than those compelled by rush-hour commuting.

Such an expanded work pattern is referred to as "remote work" or "remote employment."

With spaceborne communications satellites, remote work could be performed anywhere on Earth. But equally advanced technology exists or is rapidly being developed in ground-based telecommunications -- coaxial cables, waveguides, laser beams, coding, message switching, etc. -- for practical use in handling the operations of the remotely located work stations of possibly millions of individuals and their expanded work-related communication needs. One is particularly struck by the extraordinary compactness of telecommunications in contrast to the vast spaces needed for highways and subways to physically transfer people instead of their conversations; clusters of coaxial cables, waveguides under development, and laser beams in the research stage can transmit 90,000; a quarter-million, or millions of conversations or equivalent computer data, respectively, yet all can be transmitted through tubing only a few inches in diameter. We might give thought to the immensity of the transportation systems that would be needed to bring enough people physically face-to-face to carry on that many conversations.

Technology thus would not be the limiting factor in a phased development of a remote work economy. Of course, the quantitative aspects of construction of alternative communications networks to meet possibly quite different requirements under a remote work culture must be carefully and realistically analysed. Capital costs of communication plant construction are not negligible, and projection of increased network needs will be of utmost importance to avoid breakdowns in service such as we have recently experienced with unexpected loads.

Awaiting further detailed analysis, however, neither technology nor costs appear to be critical restraints in moving toward a system where a large percentage of office-type work might be done remotely.

How many persons might be able to work remotely? The National Academy of Engineering's Committee on Telecommunications gave thought to this in the aforementioned NAE report⁽⁵⁾, and made the particularly significant estimates -- for commuting -- that 65 per cent of all professional and technical white collar personnel and 75 per cent of all clerical workers might be able to accomplish their tasks from remote work locations (Figure 1). These two groups alone total almost 15 million out of the U.S. white collar work force of 33 million. These estimates are not broken down further; subtracting those who commute from one point to another in the suburbs would raise

their magnitude and significance for the potential impact of remote work on commuting to the central business district.

It will be noted in Figure 1 that only 20 per cent of the work of white collar managers, officials, and proprietors could be done remotely, according to the NAE estimate. This is understandable; a manager must interact frequently with members of his staff, and must often persuade and motivate, tasks that might be difficult to accomplish other than in a face-to-face mode of communication. The recognition that many jobs can not be done remotely should not blind us to the potential over-all economic, personal, and social advantages of having those that can be, possibly a large majority, done in this way. It might also be considered that 20 per cent amounts to each manager operating from his home only one day a week on the average, surely not an inconceivable situation.

Substitution in Practice

The NAE report does not go into any consideration of how the substitution might be made in practice. However, concept formulation has been attempted over the years, with perhaps increasing sophistication, but with little or no incorporation of quantitative data or projections of cost elements.

A proposed pilot study in substituting telecommunications for transportation was outlined in 1963 by Memmott.⁽⁸⁾ He questioned the wisdom of making large investments in physical transportation facilities to accommodate person-to-person interactions and concluded that because of increasing congestion:

"There is a strong probability that the substitution phenomenon will be forced upon us whether we desire it or not."

(There are possibly stronger mandates than congestion, as will be discussed.)

A perceptive analysis was made in 1968 by Healy.⁽⁹⁾ He speaks of the Home Remote Work Center and the Neighborhood Remote Work Center, which would be within walking distance of many individual residences. While the former, a simple home office, might be tied satisfactorily to the telecommunications network by telephone, the latter would permit more cost/effective sharing of expensive facilities such as computer terminals or facsimile transmission devices. Healy does not discuss the organization and operation of a Neighborhood Remote Work Center, but we may picture a suburban version as occupying a typical residence shell, with attractive landscaping to preserve the esthetic environment. (A precedent is the house-like enclosure of substations by electric utility firms.) For an urban version, one floor of an apartment complex could be equipped to provide remote work facilities for the residents, who would then "commute" by elevator to use telecommunications facilities complementing those in their own apartment work areas. Combination of offices and apartments is increasingly urged to assure the continued existence of a "24-hour city"; remote work would still be advantageous in

increasing the flexibility of residence location in relation to the employer's central office. Also, remote work need not be more remote than across the street or even in the next apartment. The reduction in office space made possible by greater utilization of the employee's residence would actually make apartment-office mergers more feasible.

Healy discusses the elements of a conceptual decision matrix (Figure 2), in which all elements of advantages -- economic, psychologic, and social -- to the employee, his company, and society are multiplied by weighting factors. By evaluating the elements of this matrix for each mode of substitution being considered and using some decision model, a decision could be made on the

Clearly, what is now needed is an intensive development of remote work on a broad interdisciplinary front, analysing all aspects of its impact on the complex structure of our economic life and particularly on the urban environment. Viewpoints as diverse as those of architects (adaptation of buildings for remote work and redesign of compacted offices), executives (work discipline of remote workers), union officials (concern for employment), fiscal officers (receipts from mass transit), sociologists (increased or decreased work for disadvantaged, uneducated, mothers of dependent children), and urban planners (return of workers to city or further urban sprawl) will have to be examined and reconciled. The task will be complex and challenging. In his study of urban dynamics,

| Assumed Susceptibility of Work-related Trips of the White-collar Work Force to Substitution by Telecommunications (1966 Data) | | |
|--|--|---|
| White-collar Subgroup | Susceptibility of Work-related Trips to Substitution | Number of People Involved in Substitution |
| Professional and technical | 65% | 6,051,000 |
| Managers, officials and proprietors | 20% | 1,481,000 |
| Clerical workers | 75% | 8,859,000 |
| Salesworkers | 5% | 227,000 |
| TOTAL | | 16,618,000 |
| After NAE ⁽⁷⁾ | | |

Figure 1

relative over-all value of the changeover. Economic elements include savings in commuting expenses, reduced office space (a large savings at today's rents), reduced parking facilities, and savings to the city on construction and maintenance of unneeded transportation systems, as well as costs of additional communications equipment, furnishing the home office, maintaining the neighborhood remote work centers, and so on. Abundant cost data is available if these elements were to be projected. Psychological and social elements of job satisfaction, change in living conditions, closer family ties, and possibly home distractions while working, could be probably measured only by surveying participants in a demonstration project.

Healy does not attempt to quantify this matrix for any particular substitution mode, and raises the question as to who will be the decision maker. "It is apparent that employee, company, and society as potential decision makers, will not put the same weight on the various elements of the measurement matrix."

Forrester⁽¹⁰⁾ points out that complex systems, such as an urban area or an economic process, resist policy changes, have long term effects quite different from short term responses, and will usually react counter to intuitive solutions. Nevertheless, complex systems may have a high sensitivity to some changes; perhaps there is an inherent feature of remote work that, if implemented, could bring it in time into general use and also generate major improvements in the whole pattern of urban life.

Broader discussions of concrete examples of remote work are needed to bring in into more general awareness as a practical possibility. For example, the first step to practical implementation of remote work is the recognition that it is not necessary to make a vast technological and cultural changeover in a single day, suddenly dropping all rush hour commuting and having everyone start work at home or in his neighborhood. Instead, remote work development lends itself very well to gradual implementation in phased steps, with great flexibility by individual companies

and their employees. We need to realize, too, that the employee will not be spending 100 per cent of his time at home, that he will not disappear into what has been termed "electronic isolation." Healy mentions one disadvantage of the home remote work center as being the "psychological problems related to isolation from one's business associates."

Alternate-Day Commuting

In fact, if an employer, whether in the city administration, or in the Federal government or private industry, were to start a remote work program, the first thing he might try would have nothing to do with telecommunications. He might simply provide a group of his employees, say typists, with adequate office equipment in their homes and have them come into the office on alternate days to deliver their previous day's output, work at an unused desk, and pick up material for home transcription. Even the savings from such a simple arrangement might be substantial. Half the employee's commuting trips would be

jobs, applicable technology also is available. Records and correspondence files on microfilm or microfiche can be set up at any number of remote locations, recorded data can be obtained from computer storage over a Touch-Tone phone, Picturephones could be installed where visual contact is essential, computer terminals can be installed when the cost is justified, and so on. Conference and group calls are already familiar working tools in business and would be particularly useful in transferring information to a remotely located staff.

Assembly Line Remoting

Even factory operation is susceptible to remote work procedures. So-called numerical control of machine tools relieves even the operators of being in close proximity to the production equipment, and adds to the percentage of managerial, clerical, and service personnel, who are much less tied to the ritual of commuting. Automation may be about to enter a new phase of acceleration. In 1965, a Presidential

| Remote Work Decision Matrix | | | |
|--|-----------------------|-----------------------|-----------------------|
| | Employee | Company | Society |
| Economic | $\lambda_{11} p_{11}$ | $\lambda_{12} p_{12}$ | $\lambda_{13} p_{13}$ |
| Psychological | $\lambda_{21} p_{21}$ | $\lambda_{22} p_{22}$ | $\lambda_{23} p_{23}$ |
| Social environment | $\lambda_{31} p_{31}$ | $\lambda_{32} p_{32}$ | $\lambda_{33} p_{33}$ |
| <p>p = measures of profit or gain resulting from substitution of communications for transportation</p> <p>λ = factor to make measures consistent and weight the elements in accordance with the special interests of the decision maker</p> <p style="text-align: right;">After Healy(9)</p> | | | |

Figure 2

eliminated, yet she would still have abundant contact with the office and fellow employees for motivation and job discussion. The employer would have an immediate benefit in compacting his office space, at the cost of some relatively inexpensive typewriters and furniture.

As experience is gained at this level of innovation, the employer could move on the next step: instead of having the typist pick up dictated work at the office on her alternate days, he could couple the office dictation equipment to the telephone system (equipment is already available) and transmit the dictated material to a corresponding recorder at her home. Advances in telecommunications are assuring that telephone lines to individuals' homes will have broader bandwidths so that faster transmission and more efficient use of the whole communication system becomes possible.

For the higher technical and professional

Commission on Technology and Automation predicted that if all productivity gains from 1965 to 1985 were taken in the form of leisure, one possibility would be a typical work week of only 22 hours.⁽¹¹⁾ However, unless the present trend to increasing commuting distances is reversed, we may merely replace the saved time by extra hours of commuting. In fact, unless technology makes a change possible, or social or legal forces impose a drastic revision of work patterns, we may see the day when more time is spent traveling to work than working.

In a futuristic, unquantified, look at remote mechanization, Albus⁽¹²⁾ stresses the potential technical and social advantages of robot operation of machines and services from very distant control centers, and proposes that the development of remote employment opportunities via advanced communications and robotics be established as a primary national goal.

Once we are tuned in to the idea that remote work techniques are practicable, we can take a systems approach to the over-all process by which office-type work is accomplished. We no longer accept commuting as an end in itself, so that only various modes of transportation are studied.

This is not to say that we can abandon our present mass transportation efforts. Innovative concepts are urgently required to satisfy genuine needs for shopping, medical services, cultural and recreational activities and essential travel to work that can not be done remotely. What the remote work concept does is make us aware that there are options to the ultimate futility of unending expansion of commuter transit, as recognized by urban planners. On this point, Forrester⁽¹⁰⁾ says:

"Urban transportation systems can encourage land separation into large nonintercommunicating sectors. The better the transportation system, the less the interleaving of population classes and the less the proximity of housing to industry. As sector separations increase, commuting cost rises rapidly in transportation cost, in psychological trauma, and in time lost from productive activity. Furthermore, transportation can span the deteriorating areas, helping to hide them and making renewal less pressing and less likely."

He suggests that for production needs, urban transportation planning should be focused on transportation between industrial centers. In New York City, for example, this would be between the new industrial parks that the city's Economic Development Administrator reports are beginning to place industry in significant numbers.⁽³⁾

"The transportation would serve the communication needs of effective economic activity but would not be primarily for long-distance commuting from home to work."

Recognizing the necessity for transportation, as well as its limitations, we can move on to examine the fundamental problems of remote work and to establish incentives to bring about a conversion from antiquated work practices to the economic and social advances inherent in remote work principles.

Management Accommodation

Behavioral, rather than technical, problems will be the critical barrier to full remote work implementation. Fortunately, both management science and practical business experience offer assurance that this barrier can be overcome. New management skills will have to be developed, but there is no reason to question the ability of businessmen and government administrators to develop these for their respective employment situations. We know that some firms are implementing innovations such as the 4-day, 40-hour week.⁽¹³⁾ This presents problems of rearranging work hours that would also be encountered in any remote employment variation that involved spending part of the time at a central

office. Office managers would have to pay more attention to identification of work units, planning work assignments, and scheduling their completion. They would become more task-oriented to the actual work output rather than to the presence of employees at their desks between certain hours. Personnel would have to be trained for effective work at home or at their neighborhood center. Here, the experience of professional writers and others accustomed to working individually can be applied. For example, writers often advise that a desk is reserved solely for their "official" work, so that they become conditioned to start work as soon as they sit down. Remote work development will include collecting such experiences and testing them on a progressively widening circle of participants in various types of jobs.

The real problem in bringing the remote work concept up to the takeoff stage is the old one of cultural inertia. A strong motivation is needed to assure that management takes serious steps to break the habits of a lifetime, and more specifically to take commuting costs and possible alternatives into account in every management decision. An ideal incentive would be directly measurable in dollars for precise accounting and for demonstration of the cost effectiveness of remote work procedures over work patterns that require extensive commuting.

Door to Door Pay

Undoubtedly, there are many incentives and pressures that society, as represented by the city, state, or Federal government, could use to encourage business firms to initiate remote work programs. Such incentives might have strong second-order impacts on many aspects of our complex society; for example, on urban renewal or on the relative location of industry in the suburbs vs. the city. Any incentive must be carefully studied as part of a progressive, phased implementation. The following suggestion, therefore, is not one to which we should become irrevocably committed, but is presented as a particular option that would appear to make a profoundly beneficial contribution to the viability of the city as a continued center of life, culture, and economic development. Furthermore, it avoids an authoritarian external control over specific aspects of business operations in favor of an internal, self-initiating mechanism that would produce its results as natural by-products of business logic and rationale.

Such a motivation and internal directive would be brought into action immediately if the Federal government were to require that firms pay all the commuting expenses of each employee -- including payment for his time at his regular salary or wage rate -- as part of the costs of doing business. "Door to door" pay would then become as accepted as the portal to portal pay that workers have won in some industries. Needless to say, all levels of government, with their very large numbers of employees, would also have to conform to the new pay practice.

This is an admittedly audacious proposal, so it should be emphasized that it is not intended to benefit the commuter nor to further tax the

businessman, but to bring about automatically the highly desirable social and cultural changes that are inherent in remote work principles. Clearly, door to door pay is not an added economic burden on the nation, for it neither increases energy consumption nor requires additional labor. Basically, it is just a paper transaction from present pay systems. The dollar figures for salaries, and prices and costs of commuter-produced goods would adjust across the economy with no net change in value. What is really significant, every employer would have always on his ledgers before him a substantial dollar figure that would encourage him to think about ways to reduce it. If he had to pay an extra \$4 or \$5 a day (\$1000 to \$1250 a year) to, say, a typist, he would very quickly see the cost benefit to himself of delivering a typewriter and other office equipment to her home, arranging for her to come to the office less frequently, and searching out advanced technology by which work could be transferred to her and the finished product returned to the office. For his higher salaried professional staff, his decision would be even more quickly triggered.

Even more important -- and here we come to the beneficial impact of remote work on the city as distinct from the sprawling suburbs -- door to door pay would throw the whole subject of home location vs. work location into negotiation.

Let's digress for a moment. One great advantage claimed for the remote work concept is that we could live where we wanted to. "The age-old problem of how to live in that idyllic 'Shangri-La' and still bring home a paycheck would be solved (for some)."(9) It sounds wonderful if we give no thought to inevitable changes, but second thoughts may make us aware that the advantages of remote living are advantages only so long as relatively few take advantage of them. The great majority of us must face up to the fact that we cannot escape to a natural paradise and we must come to a mature recognition that if we want a Shangri-La, we must build it where we are. We should certainly be aware that the continuing flight to the suburbs is destroying the city. Yet it is possible to conceive of so designing and maintaining a city -- if there were a strong motivation to do so -- that it would be pleasurable to live in.

So let's look in on an employer in downtown Manhattan in the near future. He has set up a remote work procedure and finds that it is working well. In fact, he is accomplishing the same work with half the office space that he once rented. He is also operating under the legal requirement to pay his employees the full cost of their commuting. Even though they work remotely half or more of their work time, their remaining commuting is still a recognizably large sum in his operating expenses. What will be his next step in attempting to maximize his profits?

Return to City?

Clearly, he would like to negotiate with his employees to move closer to the office; undoubtedly new job applicants would have their addresses taken into account before being hired.

This is a shocker. Perhaps we feel that even the implication of any restraint on where we might live would be an unbearable infringement on our personal liberty. Before we commit ourselves to that unproductive generalization, let's think it out. Often, freedom to live where we want really means the freedom to cut and run from a perfectly satisfactory location to one with many less desirable features (such as commuting) as a primitive reactive response to some social change, such as the in-migration of minorities, or the very beginnings of problems such as pollution or crime. Changes would go more smoothly and problems would not get out of control if we stayed put and cooperated in and insisted upon rational solutions. True freedom in this context might be interpreted as the assurance that all locations where we work or live, as our careers and interests change through life, will be intrinsically equivalent in space, environment, good schools, and access to recreation and entertainment; different in style, or course, but thoroughly acceptable as a new and worthwhile living experience. But to establish this reach of freedom will require strong forces of self-interest; once established, it might be so attractive and so embedded in custom and revised administrative regulations (e.g., zoning) that it could continue on its own.

This is not just dilettante futurism. There are strong economic and social forces pointing to major changes in the residence-work relation, and unless understood and accommodated to, they are likely to be unexpectedly and erratically applied, disruptive, and probably will lead far afield from the optimum arrangement we have just discussed.

Economically, we have suddenly become conscious of a crisis in the assured supply of adequate energy. The brownouts and blackouts that we can expect indefinitely are something of a handwriting on the wall. All natural resources are being subjected to a far more competitive demand than in the near past. Every automobile that is bought in the rapidly developing countries of the world is an added inducement to oil producers to raise prices and adopt more stringent conservation measures. Nuclear power will not be cheap and may be limited in output by environmental considerations. We are facing drastic increases in the operating costs of everything that consumes fuel -- automobiles, busses, subways, heating and air conditioning, and lighting of homes and offices. The situation is not catastrophic -- we can still maintain a high standard of living, even an increasing one -- if we revise our living and working habits to accomplish the same ends but with substantially reduced energy use. One way this can be done is to save on transportation and dual upkeep of offices and homes by converting to remote work.

Judicial Intervention?

More important than natural resources in forcing us to consider a substantial change in our living-commuting-working complex will be the dynamics of social pressures rising to some effective action as expressed in administrative and judicial decisions. What will judges likely hold in the future that will influence the work-

residence relationship? We typically do not attempt to make such projections, yet proponents of systems analysis warn us that to ignore any possible factor is to make a decision concerning it: that it will remain constant, or in this case that courts will stop making decisions. For example, it would be a futile exercise to design a guideway to carry large numbers of personal vehicles downtown if we can project that downtown residents, backed up by the city administration and the courts, have made a firm and lasting emotional commitment against letting any such vehicles come into the city at all. Or at least, the designer would have to include a highly convincing demonstration that the proposed system would be acceptable to the community's new consciousness of adverse environmental and social effects.

In light of numerous administrative and judicial decisions in the past few years, there does appear to be a strong trend in a direction that ultimately may cut the ground from under the whole rationale of commuting -- to live at a distance from one's work. Higher income taxes on commuters, suggestions for confiscatory parking fees, and readiness to block off streets to automobile traffic are examples. However, these are minor when compared to the implications of recent examples of the increasing readiness of Federal administrators and judges to intervene in the labor market and in the provision of municipal services in behalf of minorities. There is a growing readiness to consider the actual percentages of identifiable groups (blacks, Spanish-American surnames, American Indians, etc.) that are resident in given areas and to correlate these numbers with their relative access to jobs. Facts in the construction industry, for example, commit the industry to aim for minority representation in the work force "at least proportionate to their percentage in the community". Labor Department guidelines for minority hiring by all Federal contractors suggest specific goals and targets related to minority percentages.⁽¹⁴⁾ With a growth in commitments to this attitude, it is conceivable that the courts will hold in time that, as a matter of justice, employment by any firm in a certain location must approximate the group-by-group percentage makeup of the residents within a certain distance. The ultimate impact on commuting, provided conditions of segregation remain somewhat as they are now, is obvious.

Needless to say, the large numbers that work downtown, and the relatively limited number of residences in the city at present, would act against any precipitous drop in commuting. Nevertheless, the combination of much higher transportation costs and employment restraints might be a strong incentive to toll many suburbanites (the next generation, probably) back to town and keep the newly successful city dweller (of whatever group) from leaving. This reversal of the present trend away from the city would operate more positively and with more acceptance and approbation if it were assisted by job use of residence space and with place-of-residence negotiations based on door to door pay.

Walk to Work

Place-of-residence negotiations would necessarily be drawn out over many years because of the inertia in construction of new residences in the city (or remodeling of many that are now being abandoned) and the fact that millions of people are involved. (Door to door pay would affect every member of the work force, not merely those white collar employees that can do some of their work remotely as tabulated in Figure 1.) The dynamic change toward a complex balance among the distances of the employees' residences from the office, the cost of commuting, and the influence of whatever factors (economic, social, and cultural) cause the office to be in its particular location perhaps could be simulated, using existing techniques of urban economics, urban dynamics, and business location analysis. In any case, the employer would want to have the bulk of his employees as close as possible, preferably within close walking distance. Suddenly, economic logic would be joined to the social benefits of merging office and residential construction. Making it possible to live close enough to walk to one's central work location would suddenly become a major goal of city planners and construction firms (the latter in part because less office space would be needed). As Mayor Lindsay says of the Battery Park development: "The walk-to-work principle is very important."⁽¹⁵⁾

In actual practice, the remote work system would be more complex than we can fully hypothesize at present. New businesses might develop; to operate neighborhood remote work centers, for example. New office techniques would evolve; for example, there almost certainly would be an accelerated trend to replace written records by electronic characters in computer storage and display, or by oral messages switched to home tape recorders. A more rational distribution of work and residences is strongly indicated, including perhaps the location of more work where people need it. Architects would evolve new designs appropriate to human value in a combined work-residence culture. Certainly some options offer the hope of returning the central city to one with a better mix of income levels, of improving city transportation by insisting on its rational purpose of moving people when they really need moving and not when they don't, i.e., for daily commuting, and, above all, of reversing the trend toward the disappearance of life in the city.

Program Development

Whatever the potential of this new direction in applying technology with social awareness, we must realize that it will not be realized unless a continuity of effort is assured and an effective policy-formulation process is established. Professional societies concerned with urban technology could contribute by including in their future meetings sessions devoted to alternatives to commuting. City management could incorporate a remote work development function in its administrative structure. The Federal government, particularly, could take the lead in coordinating remote work development with its support of mass transportation, telecommunications, and urban

development. To serve as a focal point, the government could establish within an appropriate department or agency an Office of Remote Work Development.

The new office could have the usual functions common to program development. It could, for example:

- Conduct demonstration projects by determining the work patterns of residents in representative suburban and city areas and securing cooperation for test demonstrations of remote work activities.
- Identify the technical, economic, and social impacts of large-scale implementation of remote work patterns (a technology assessment function).
- Project advances in telecommunications, office techniques, and information storage and retrieval that might be applicable to remote work activities.
- Evaluate experiences gained during program development and inform municipal administrators, government agencies, private industry, and labor officials of demonstrated benefits and problems.
- Provide background information with respect to remote work requirements to offices of city, state, and Federal governments that have responsibility for developing telecommunications, transportation, and urban policies.
- Maintain a continuing study of remote work effects on life styles, employer-employee relations, and other cultural and behavioral aspects.

Conclusion

A sense of urgency, responsibility to our own future and that of our descendants, and vision to see the possibilities in a truly new approach: all are essential to understanding the potentialities of the remote work concept and to take steps to bring it into being. Even a few years delay will mean closing out more options; decisions will be made in that time to construct additional building complexes designed for an obsolete working tradition tied to commuting rather than for a new, more human way of urban living and working. And these will be massive and immovable, determining the appearance and function of the city for centuries to come; the 10th generation of our descendants will still be confronted by the World Trade Center, for example. Vision, above all, is imperative; to paraphrase Proverbs: "Where there is no vision, the cities perish."

In closing, some words from a review by David C. Anderson⁽¹⁶⁾ of books about noise pollution, another urban problem that remote work would alleviate, seem particularly appropriate:

"The time seems past for identifying new ways man and his technology misuse the environment....Far more necessary

is some fresh, hard-headed thinking about human technology, the problem of values it creates, and most important, the practical social and economic policies that might be used to deal with it."

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